

# A Proposed Qualitative Methodological Tool for the Encapsulation of Strategy and Culture Approaches in High-Tech Markets

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## Abstract

The purpose of the present paper is to gather and describe in a compact way those particular characteristics dominating the high-technology sector, and therefore to illuminate further those parameters through a holistic and systemic approach. To achieve this broad encapsulation of characteristics, an extensive literature review has taken place. Given the catalytic contribution of new high tech products in the survival - profitability of high tech enterprises, and given the peculiar environment within which they develop, this paper composes the strategic and cultural approaches adopted by high tech enterprises in order to effectively cope with the extremely competitive environment. Also, it provides high tech companies with an effective complementary qualitative framework to increase the levels of understanding and to further enforce their decision making capabilities.

**Key words:** High technology, Strategic-Cultural Approaches to High Technology, Systemic Approach, Qualitative Framework.

## Introduction

The market of High Technology products is described as “turbulent”, “volatile” and “tumultuous” (Abell, 1980). The distinctiveness of the high tech sector is shaped by parameters that differentiate its qualities (Abell, 1980).

The continuously growing whole of complex operational activities (Abernathy, Utterback, 1978) and the complexity of high tech products both constitute defining coordinates for the landscape in which high tech enterprises operate. Baker et al. (Baker et al., 1980) describe the determinants of this environment (through the resultants that compose its framework) as inflexible and unreceptive.

The objective of this work is the brief listing of features composing the high tech market environment, and also the approaches of strategies and culture that are suggested by the literature and are used by high tech enterprises.

The building blocks of culture assume many forms varying from material artefacts – tools, entrepreneurial structures – to behavioural regularities such as working interrelationships, economic exchanges, legal sanctions, and followed procedures, to abstract concepts and beliefs. All of these complex manifestations share one feature in common; they are symbols and as such express meaning. This is valid for both the demand side and the supply side of the high tech markets. While the ‘chasm’ and certain aspects of the ‘market tyranny’ as well as the ‘market uncertainty’ can be attributed to the high tech’s consumers culture, at the same time the ‘cannibalism’ or the conversion of capabilities into rigidities, or the remaining aspects of uncertainty, reside within the high tech company.

Culture traits and broader cultural patterns inclusive of language, terminology, technology, institutionalized beliefs, and values are transmitted across generations of managers and executives and maintain continuity through learning, technically termed enculturation. Cultural elements as symbols assume their meanings in relationship to other symbols within a broader context of a meaning system.

What has to be highlighted is the fact that both the strategies and the cultural approaches adopted dynamically interrelate and shape the each time existing context. For example, the conver-

sion of core capabilities into core rigidities is a factor that stems without any doubt from a past cultural approach which was formulated within the boundaries of the company. This approach is what formatted the undertaken corporate strategy – as a chain reaction. The fact of the relentless interaction is valid for almost every strategic approach and cultural framework that shape the high tech environment and is described below. What constitutes this constant interrelation interesting is the magnitude of their interference to the longevity and prosperity of the high tech enterprises.

Moreover, the organization of the aforementioned factors entirely into a brief diagram, may function on one hand as a tool for listing the status that each technology goes through, and on the other hand as a qualitative complementary tool in the planning and mapping out of the future strategy of high tech enterprises – mainly based on the status of technology at that time.

## Description

The methodology used in this paper is an extensive journal and bibliographic research.

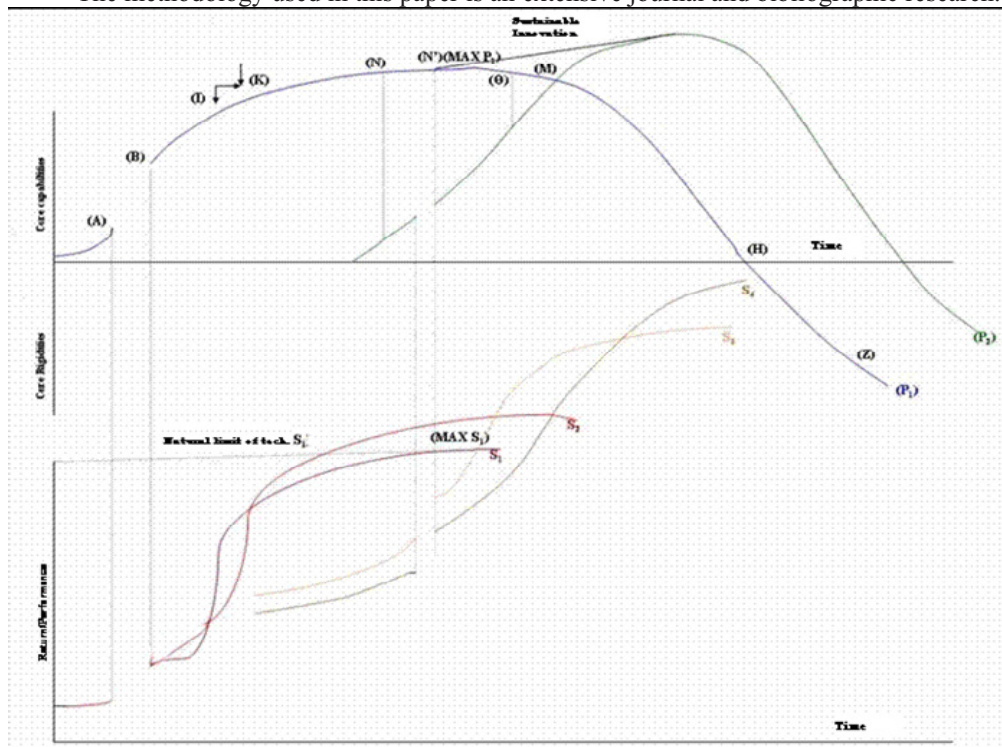


Fig. 1. Composition of strategic approaches of culture

The factors herein proposed – in the bibliography and journals – as resultants and distinctive characteristics of the high tech enterprises scope of activities are:

- Conversion of Core Capabilities into Core Rigidities, (Boulang, Morgan, Staelin, 1997), (Brockner, Rubin, 1985), (Pankaj, 1991), (Clayton, 1997), (Clark, 1985), (the Innovation-Core Capabilities relation)
- Existence of the “chasm” (Cooper, Schendel, 1976)
- Uncertainty (Cooper, Kleinschmidt, 1986), (Copolsky, 1976), (Gardner et al.), (De Meyer, 1985), (Deshpande, Webster, 1989), (Barton, 1992), (Duncan, 1972), (Emery, Trist, 1965), (Emery, Trist, 1965), (Landmayer, 1995),
- Market Tyranny
- Life cycle of the technology curves “S” (Foster, 1986)

- Cannibalism (Foster, 1986), (Gardner, 1990) (Goldhar, Bragaw, Schwartz, 1976) Grunenwald, Vernon, 1988), (Hamel, 1997), (Hamel, Prahalad, 1991), (Hannan, Freeman, 1997), (Hayes, 1985), (Hayes, Wheelright, Clark, 1988), (Henderson, Clark, 1990), Hoffer, Schendel, 1978)
- Progression of innovation (Jauch, Kraft, 1986), (George, Weiss, Dutta, 1999), (Katz, Kahn, 1966), (Roger, Harvey, Rothe, 1978), (Kleinschmidt, Cooper, 1991), (Leonard, 1992), (Lieberman, Montgomery, 1988), (Link, 1987)
- Demonstration-Explanation of the strategic approaches / culture approaches in High Technology markets

The second of the two parallel diagrams in Figure 1, shows the relation that exists between the core competencies (Marquis, 1982), (Mason, Milne, 1994), (Milliken, 1987), (Moore, 1991), and time. Both curves  $P_1$  and  $P_2$  have initially positive slopes, which become negative only after reaching their peak ( $\max P_1$  and  $\max P_2$  respectively). It is thus demonstrated that the fact that the framework of core competencies, as time passes and within turbulent markets, is converted into core rigidities (Moore, 1991), (Moorman, 1995), (Nault, Vandenbosch, 1996), (Nelson, Winter, 1982) (Pavitt, 1991). Therefore, the curves  $P_1$  and  $P_2$  describe the innate attribute of core competencies in high tech markets.

In particular:

1) From point O (separating line between core competencies/rigidities) up to point A,  $P_1$  has a positive slope. This is due because the product appeals to “early adopters” market segment (Porter, 1982), (Quinn, 1980) (innovators). The smooth slope is the result of the following that is not yet clear; namely, the suitability of core competencies and the match between the need that the technology wishes to cover, the extent to which it wishes to cover that need, and generally the factors that compose the ingredients of the three factors of uncertainty (Quinn, 1992), (Quinn, Cameron, 1988), (Chandy, Tellis, 1998), (Kasturi, Bartus, 1995), (Rosen,, Sechroeder, Purinton,, 1988), (Rothwell, Robertson, 1973), (Moriarty, Kosnik, 1989).

2) From point A up to point B. The curve is discontinuous. This happens so as to demonstrate the chasm (Moriarty, Kosnik, 1989) (Figure 2). The chasm is the peak of uncertainty groups distinguishing the high tech markets, and is actually the distance separating the capture of early customers (or visionaries or early adopters) from customers who are pragmatists, and who also constitute the critical quantity of the segment necessary for the adoption of the product / technology (Moriarty, Kosnik, 1989). The step of moving from capturing early customers to capturing the critical mass is the indicator that will show the success probability of technology. The existence of the three types of uncertainty is the reason for the curve discontinuity, since failing to overcome them (or at least to effectively “calm them down”), is translated into a negative slope, i.e. to the opposite direction from the aspired goal. It should be stressed that the transition from the early to pragmatist consumers is not the only prerequisite; the speed of transition plays also a critical part, since this is also a variable included in the uncertainties. Consequently, it is of our interest the distance from A to B to be the shortest possible (variables of the distance are the three groups of uncertainty), and the transition to be the soonest possible (transition variates are the core competencies).

3) From point B up to  $\max P_1$ . The core competencies have multiplicative positive effects, if the chasm is overtaken. The slope of  $P_1$  is positive due to the “spiral” (increase of benefits in an increasing rate) technology adoption – core competencies framework, and their positive correlated magnitudes.

4) Points I and K in the positive part (B- $\max P_1$ ) of  $P_1$ . They represent expeditionary marketing (Rubenstein, 1976), (Figure 1). The introduction of marginal improvements and the anticipation of the public reaction along with the feedback from the proposed improvements / changes, combined with the fertile ground provided by the core competencies framework, all help in approaching the perfect strategic fit of technology and its use in order to satisfy the needs. Furthermore, it contributes to a more efficient exploitation of the core.

5) Point max – descend. Descend comes after the peak. It is the result of the myopic view of needs satisfaction (or else, tyranny of the served market), which commands the satisfaction of the current needs using the same – inferior technology. The size of the slope’s negativity is per-

fectly proportional and consistent to the slope of technology curve  $S_1$ . In the case where the max of  $P_1$  corresponds to the max (natural limit of technology) of  $S_1$ , then, the negative slope of  $P_1$ , after the max, will be steeper, since the core of capabilities will be weakened in an increasing rate due to the technology fading (and its rapid rate) of  $S_1$ . If the max of  $P_1$  corresponds to an ascending part of the curve  $S_1$  i.e. to  $S_1'$  then again the core capabilities will tend to descend (due to technology  $S_2$  is still at birth) but the descend will be slower, since technology  $S_1$  has not yet reached its natural limit, but it simply approaching it.

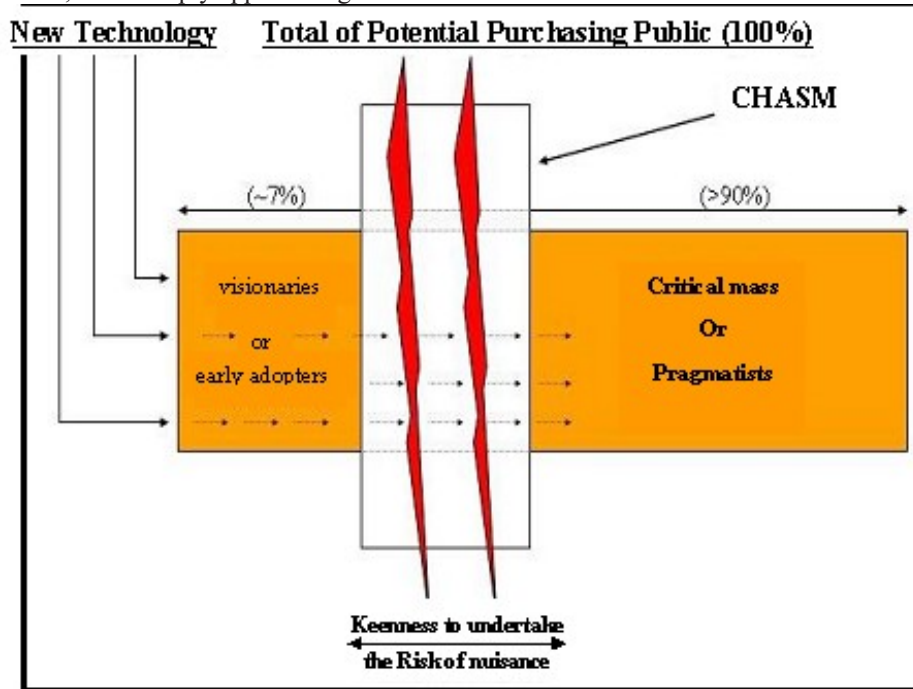


Fig. 1. The chasm

6) Point H up to point Z. All core competencies have been converted into core rigidities. Core competencies in continuously changing dynamic and unstable environments, such as the high tech (Schumpeter, 1942), (Shanklin, Ryans, 1984), (Siegel, 1998), (Teece, Pisano, Shuen, 1990), (Tushman, Anderson, 1986), (Utterback, 1994), (and with a short product life cycle) can easily – as time passes – be converted into barriers for further innovation development. Core competencies (which reflect to great extent to or/and consist of the preference in existing – known technologies – routines – practices – norms, principles, culture, prestige) (Utterback, 1994) (Veryzer, 1998), (Weick, 1979), (Souder, Moenaert, 1992) have created and established a framework – a certain angle of viewing things that tends to face through the same viewpoint the new facts. The “old” (and successful) formula uses the same means to receive and translate signs – ideas – facts, and to convert them into materialised – useful – acceptable innovation. In the course of time, and in the presence of an extremely dynamic environment (environment of vortex), core competencies are transformed into core rigidities, i.e. they become a factor of deliberate delusion or blindness and they correspond to negative yields.

7) Points N and Θ. Point N is found on the ascending part of the curve P, while Θ – on the descending. They both represent the possible transition points in new technology  $S_2$ , as well as in curve  $P_2$ . If N has a projection to some point on  $P_2$  before the chasm of  $P_2$ , then (with the new framework of core competencies also present) the enterprise starts all over again the course, always having to face the chasm of  $P_2$ , and simultaneously it has destroyed the core competencies, while  $P_1$  was still ascending (positive slope). On the other hand it is noted, that being the first en-

terprise that is introducing new technology, it will also profit by the first mover advantages of the market (of course if it passes the chasm of  $P_2$ ). If N has projection to some point of  $P_2$ , after the chasm, it enjoys the still positive consequences of core capabilities at  $P_1$ , does not run the risk of chasm (but it is also not “shaped / educated” from it), and misses the first mover advantage of the market.

This advantage is obviously more important in high tech markets due to the short product life cycle, the rapid fading, credibility etc., but also due to the fact that as a follower, it can learn and re-adopt technology by taking advantage of the feedback produced by the competitor and his actions. That is to say in other words, the market pioneers succeed or fail to implement the dogma of expeditionary marketing without the risk of failure but with also less positive consequences than those they would have if they would have done it alone.

Regarding  $\Theta$ , it is stressed that, based on its projection on  $P_2$ , probably the enterprise will take the shape of the “me-too” type. In addition, within the enterprise, the transition to a new core competencies framework will be easier since the conditions will have matured ( $P_1$  descending).

Finally, it should be noted that the transition from any point of  $P_1$  to  $P_2$  presupposes the rejection, if not the ruin, of the existing (in  $P_1$ ) core competencies, to a rate respective to the distance of the point on  $P_1$  from the horizontal axis. Certainly the existence of a golden solution is possible, i.e. the continuation of the course along the whole of  $P_1$  (or up to the point where there are positive economic results or clear reasons indicating that) and simultaneously (with the assistance from resources), re-establishment of the core competencies and course on  $P_2$ . With this “portfolio” of core competencies, risk is minimized while the sustainable leadership and development is ensured (as proficient the term “ensure” can be).

8) Point M, the section point of  $P_1$  and  $P_2$ . It presents that new technology has been introduced and has replaced the old one to a great extent. On the right of point M, the difference of the old framework with the new framework of core competencies increases due to the simultaneous existence of a negative slope in  $P_1$  and a positive in  $P_2$ .

9) Regarding  $P_2$ , a prior analysis can be done as well as a relative comparison to  $P_3$ . However, its max is higher than that of  $P_1$  because (even given the positive magnitude of the influence by the core competencies) the new technology  $S_2$  has higher yield than  $S_1$ . Thus, based on their multiplicative relation, (spiral) the yield of the (new) core competencies also increases respectively.

Finally, S represents the known technology curves (Wind, Mahajan, 1997) while the parallel straight lines having the axis of time show the technological natural limit, i.e. the point beyond which technology is impossible to improve, even marginally. There is also equivalence of chasm and discontinuity of S, due to the fact that technology can be also abandoned because of factors constituting the uncertainty of technology (mainly).

## 2. Implications/Conclusions

The environment where high tech enterprises operate is demanding. The composition of its distinctive features, as well as the ways of reaction and approaching the markets is mostly described in Figure 1. Given the adoption of the proposed framework / diagram, the managerial implications / contribution are:

A framework is given in high tech enterprises, based on which the mapping of the current status of each technology of the curves “P” is feasible, but also, the reasoning of the followed strategic course and options of the enterprise.

On the basis of (1), the course of the non-stop sustainable development of technology is demonstrated in theory.

The turning points from which each technology passes in the course of its life cycle now appear.

It is strongly shown how useful is for alternative approaches (cultural & strategic) to be adopted. In addition, the consequences and potential implications- diagrams are presented.

The time horizon and the transition margin into the new technology become relatively clear (and in any case clearer than the alternative of not adopting-using the diagram).

The presentation of the aforementioned (also illustrated in the figures) in a thorough and brief manner contributes to a new qualitative methodological tool, which adds to the justified and reasoned making of medium-long term strategic decisions, and contributes to the rationality of the corporate orientation of the high tech enterprises.

## References

1. Abell D.F. *Defining the Business: The Starting Point of Strategic Planning*. - Engewood Cliffs, N.J.: Prentice – Hall, 1980.
2. Abernathy W., J. Utterback, *Patterns of Industrial Innovation // Technology Review*, June – July 1978. pp. 41 - 47.
3. Baker N.R., Winkofsky, E.P., Langmeyer, L. D.J. Sweeney. *Idea generations: a procrustean bed of variables, hypotheses, and Implications*. In Dean and Goldhar (eds. ), *TIMS Studies in the Management Sciences*, Vol. 15 Amsterdam: North Holland, 1980.- 33 – 51 pp.
4. Boulang William, Ruskin Morgan, Richard Staelin. *Pulling the Plug to Stop the New Product Drain*”, *Journal of Marketing Research*, 1997. – No 34. – pp. 164-76.
5. Brockner Joel, Jeffrey Z. Rubin. *Entrapment in Escalating Conflicts: A social – psychological Analysis*. New York: Springer – Verlag, 1985.
6. Chemawat Pankaj. *Market Incumbency and Technological Inertia*, *Marketing Science* 10 (Spring), 1991. – pp. 161-71.
7. Christensen Clayton M. *The Innovator’s Dilemma*. Boston. HBS Press, 1997.
8. Clark K.B. *The interaction of design hierarchies and market concepts in technological evolution // Research Policy*, No 14. – pp. 235-51.
9. Cooper Arnold, Dan Schendel. *Strategic Responses to Technological Threats*, *Business Horizons*, February, 1976. – pp. 61-69.
10. Cooper R.G., E. J. Kleinschmidt. *An Investigation into the new product process // Journal of Product Innovation Management*, 1986. – 3, – pp. 71-85.
11. Copolsky William. *Cannibalism in the Marketplace // Journal of Marketing*, 1976. – pp. 103-105.
12. David M. Gardner, Frank Johnson, Monkyu Lee, in Wilkinson, *A contingency approach to marketing high technology products // European journal Marketing*, 2000. – vol.34, – No 9110. – pp. 1053-1077.
13. De Meyer A. *The flow of technological innovation in an R+D department // Research Policy*, 1985. – 14. – pp. 315-328.
14. Deshpande Rohit, Frederich E., Webster Jr. *Organizational Culture and Marketing: Defining the Research Agenda // Journal of Marketing*, 1989. – 53. – pp. 3-5.
15. Dorothy L. Barton. *Core capabilities and Core Rigidities: A paradox in managing new product development // Strategic Management Journal*, 1992. – Vol. 13, – pp. 111-125.
16. Duncan R.D. *Characteristics of organizational environments and perceived environmental uncertainty* , *Administrative Science Quarterly*, 1972. 17, – pp. 313-327.
17. Emery F.E., E.L. Trist. *The causal texture of organizational environments // Human Relations*, 1965. – 18. – pp. 21 – 32.
18. Landmayer, Th. *The trouble with Computers Usefulness, Usability, and Productivity*. - Cambridge, MA: MIT Press, 1995. – 34 pp.
19. Foster R. (1986), *Innovation: The Attacker’s Advantage*, New York: Summit Books
20. Gardner David. *Are High Technology Products Really Different? // Faculty working paper*, 1990. No #90-1706, University of Illinois at Urbana – Champaign.
21. Goldhar J.D., Bragaw L.K., Schwartz J. J. *Information flows, management styles, and technological innovation*, 1976.
22. Grunenwald J., T.T Vernon. *Pricing decision making for high technology products and services // Journal of Business and Industrial Marketing*, 1988. – No 3. – pp. 61-70.
23. Hamel Gary. *Killer Strategies That Make Shareholders Rich // Fortune*, 1977. – pp. 70-84.

24. Hamel Gary, C. K. Prahalad. Corporate Imagination and Expeditionary Marketing // Harvard Business Review, 1991. – pp. 81-92.
25. Hannan M.T., J. Freeman. The Population Ecology of Organization // American Journal of Sociology, 1997. – No 82. – pp. 929-964.
26. Hayes R.H. Strategic planning forward – Reverse? // Harvard Business Review, 1985.
27. Hayes R.H., S.C. Wheelright, K.B. Clark. Dynamic Manufacturing Creating the Learning Organization. - New York: Free Press, 1988.
28. Henderson Rebecca, Kim B.Clark. Architectural Innovation. The Reconfiguration of Existing Product Technologies and the Failure of Established Firms // Administrative Science Quarterly, 1990, – No.35 – pp. 9-30.
29. Hoffer, C.W., D. Schendel. Strategy Formulation: Analytical Concepts. West Publishing, - 1978.
30. Jauch L.R., Kraft K.L. Strategic Management of uncertainty // Academy of Management Review, 1986.– No 11.– pp. 777-790.
31. John George, Allen Weiss, Shantanu Dutta. Marketing in Technology Intensive Markets: Towards a Conceptual Framework // Journal of Marketing, 1999. – No63. – pp. 78-91.
32. Katz D., Kahn R. L. The social Psychology of Organizations. - New York: Willey, 1966.
33. Kerin Roger A., Michael G. Harvey, James T. Rothe. Cannibalism and New Product Development // Business Horizons, 1978. – No 21. – pp. 25-31.
34. Kleinschmidt Elko J., Robert G. Cooper. The Impact of Product Innovativeness Performance // Journal of Product Innovation Management, (December) 1991. – No 8. – pp. 240-51.
35. Leonard D. Core Capabilities and Core Rigidities: A paradox in Managing New Product Development // Strategic Management Journal, 13 (Summer) 1992. – No 13. – pp. 111-25.
36. Lieberman M., D.B. Montgomery First mover advantages // Strategic management Journal. – No 2.– pp. 41-58
37. Link P.L. Marketing of High Technology: An Australian perspective. Nelson Wadsworth, 1987. Melbourne.
38. Marquis, D. G. The anatomy of successful innovations In Tushman, M. L. and Moore, W. L. (Eds), Readings in the Management of Innovation. 1987. Boston: Mass: Pitman, 42, 50.
39. Mason Charlotte H., George R. Milne. An Approach for identifying Cannibalization Within Product Line Extensions and Multi – Brand Strategies // Journal of Business Research, 1994. – No31. – pp. 163-70.
40. Milliken F. J. Three types of perceived uncertainty about the environment state, effect and response uncertainty // Academy of Management Review, 1987. Vol 12, No 1, – pp. 133-143.
41. Moore Geoffrey. Crossing the Chasm Marketing and Selling Technology Products to Mainstream Customers. – New York: Harper – Collins, 1991.
42. Moorman Christine. The Impact of Organizational of Marketing Research, 1995.– No 34. – pp. 91-107.
43. Nault Barrie, Mark Vandenbosch. Eating your own lush: Protection though Preemption // Organization Service, 1996. – No 7. – pp 342-58.
44. Nelson Richard R., Sidney G. Winter. An Evolutionary Theory of Economic Change, – Cambridge, MA: Belknap Press, 1982.
45. Pavitt K. Key characteristics of the large innovating firm // British Journal of Management, 1991. – No 32. – pp. 41-50.
46. Porter M. E. The technological Dimension of Competitive strategy // Working Paper HBS 82 -119, 1982. Boston: Harvard Business School.
47. Quinn J. B. Strategies for Change: Logical Incrementalism. - Richard D. Irwin, 1980.
48. Quinn James Brian. Personal Knowledge: Towards a Post Critical Philosophy. – New York: Q Harperard Row, 1992.

49. Quinn R., K. Cameron. Organizational paradox and Transformation. – Cambridge: M A. Ballinger Publishing, 1988.
50. Rajesh K. Chandy, Gerard J. Tellis. Organizing for radical product innovation. The overlooked Role of Willingness to Cannibalize // Journal of Marketing Research, November 1998. – vol. XXXV. – pp. 474-487.
51. Rangan V. Kasturi, Kevin Bartus. New Product Commercialization: Common Mistakes // Business Marketing Strategy, V. K. Rangan et al (eds), Chicago: Irwin. – 66.
52. Rosen D.E., J.E. Sechroeder, E.F. Purinton. Marketing high tech products: lessons in customer focus from the marketplace // journal of consumer and Market Research (online), 1988. - vol.98. – No 6.
53. Rothwell R., Robertson A.B. The role of communication in technological innovation,
54. Research Policy, 1973. – No2. – pp. 204-225.
55. Rowald T. Moriarty, Thomas J. Kosnik. High- Tech Marketing: Concepts, Continuity and Change // Sloan Management Review, summer 1989. – pp. 7-16.
56. Rubenstein A. H., Chakrabarti A. K., O' Keefe R. D. Souder, W. E., Young H. C. Factors influencing innovation success at the project level // Research Management, 1976. – No19. – pp. 15-20.
57. Schumpeter J. Capitalism, Socialism and Democracy, New York: 1942.
58. Shanklin William, John Ryans. Organizing for High Tech Marketing // Harvard Business Review, 1984. – No62. – pp. 164-171.
59. Siegel, Matt. Do computers Slow Us Down ? 1998.
60. Teece D. J., G. Pisano A. Shuen. Firm capabilities, resources and the concept of strategy // Consortium on Competitiveness and Cooperation Working Paper, 1990. # 90-9, University of California at Berkeley, Centre for Research, in Management, Berkeley.
61. Tushman Michael and Phillip Anderson. Technological Discontinuities and Organizational Environments // Administrative Science Quarterly, 1986. – No 31. – pp. 604-33.
62. Utterback J. Master in the Dynamic of Innovation. Boston: Harvard Business School Press, 1994.
63. Veryzer R. W. Jr. Key factors affecting customer evaluation of discontinuous new products // Journal of Product Innovation Management, 1998. – Vol. 15. – No. 2. – pp. 136-150.
64. Weick K.E. The social Psychology of Organizing, - New York: Random House, 1979.
65. William E. Souder, Ruddy Moenaert. Integrating Marketing and R + D project personnel within innovation projects: An Information Uncertainty Model // Journal of Management Studies, 1992. – No 24.
66. Wind Jerry, Vijay Mahajan. Issues and Opportunities in New Product Development: An introduction to the special issue // Journal of Marketing research, 1997. – No34. – pp. 1-12.